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Phytochemical Analysis of Algal Species Found in Sutrapada Coastal Region of Gujarat

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Authors' contributions

This work was carried out in collaboration among all authors. Authors KG, PD and RK wrote the protocol and first draft of the manuscript and managed analysis of study. Author SV drafted and designed the study and organized the data of the study. All authors read and approved the final manuscript.

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ABSTRACT

The aim of the present study is to assess the phytochemicals of nine marine algae species which is further divided in to three classes. The qualitative phytochemical analysis was done on nine different algae species of Saurashtra coastal belt in Gujarat. For the qualitative phytochemical analysis total 16 different parameters were analyzed on algae species. Extracts prepared in two solvents viz., chloroform extract (CE) and acetone-water extract (AWE). Amongst the two different extracts, acetone water extract showed the presence of maximum number of phytochemical compounds. Next to that, acetone, water extract showed steroid, glycosides, tannin, protein and flavonoids compounds were present in all algae species. The presence of tannins, steroid, glycosides, reducing sugar, protein and flavonoids were observed in two extracts of three algal classes.

Keywords: Seaweed; phytochemical; qualitative; extracts; coast; Sutrapada.

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1. INTRODUCTION

Marine algae comprises more than 60 trace elements in a concentration much higher than in terrestrial plants. They also contain protein, iodine, bromine, vitamins and substances of stimulatory as well as antibiotic in nature. Marine macro algae are the renewable living resources which are also used as food, feed, and fertilizer in many parts of the world [1]. Seaweeds have been reported to contain secondary metabolites which contain alkaloids, glycosides, flavonoids, saponins, tannins, steroids, and related active metabolites, and have been far used in the drug and pharmaceutical industry [2]. In *Ulva lactuca*, Qualitative phytochemical screening of the powdered green algae revealed the presence of alkaloids, flavonoids, saponins, terpenoids and cardiac glycosides is detected [3]. Seaweeds are used as an alternative source for anti-bacterial were anti-inflammatory, anti-oxidant and anti-cancer in the near future [4].The presence of various phytochemicals compounds identified through this study, rationalise the use of marine algae for various ailments in traditional therapy [5]. The presence of reducing agents in synthesizing nanoparticle can be potent antimicrobials in near future. The biosynthesized nanoparticles showed evidence of high anti-bacterial activity against all test pathogens compared to phytochemical constituents [6]. Phenolic compounds are widely distributed in the plant kingdom and have been reported to have several biological activities including antioxidant properties. The phenolic compounds may affect the growth and metabolism of bacteria. They could have an activating or inhibiting effect on microbial growth according to their constitution and concentration [7]. The major algal classes observed on coast of Sutrapada region were likely to be *Chlorophyta, Rhodophyta* and *Phaeophyta.* The seaweed recorded on the Sutrapada coastal region have many medicinal and economic uses especially in manufactoring products for the food and it is a primary source for many industries. It is reported in literatures that seaweeds have extensive medicinal properties specifically in cardiac disorders, blood purification and many other uses as these seaweed also possess anti-microbial properties. The role of phytochemicals is important in seaweeds as secondary metabolite because these secondary metabolites provide them the medicinal properties. Hence, these species of seaweed were analyzed for secondary metabolites like proteins, terpenoids, flavonoids, tannins, phytostetol, amino acid, etc. There were nine seaweeds species collected from the Sutrapada coastal area having many medicinal properties in different diseases. In the present study we investigated phytochemical qualitatively from various extracts of seaweeds. Selected nine marine macro algae were divided in three major classes which commonly occurs on the Gujarat coast.

There were three species of Chlorophyta class, (*Caulerpa racemosa, Chactomorpha crassa Iand Ulva lactuca*. Three species in class Phaeophyta(*Padina tetrastromatica, Giffordia mitchellae* and *Sargassum tenerrimum*) and Rhodophyta (*Scinaia carnosa, Halymenia venusta* and *Champia indica*) each found on the coastal belt of Sutrapada. The prime importance of this study is to highlighte the phytochemical analysis of six species of seaweeds such as *Scinaia carnosa, Chactomorpha crassa, Giffordia mitchellae, Caulerpa veravalensis*, *Champia indica* and *Halymenia venusta* are not reported till date.

2. METHODOLOGY

2.1 Study Area

Collection site is 5 km coastal belt of Sutrapada which is situated in Gir Somnath District, Gujarat. (GPS location: 20.8437°N 70.4759°E).

2.2 Sample Preparation

Seaweeds were collected for conducting qualitative phytochemical analysis of nine algal species namely *Caulerpa racemosa, Scinaia carnosa, Padina tetrastromatica, Chaetomorpha crasa, Giffordia mitchellae, Caulerpa veravalensis, Ulva lactuca, Halymenia venusta, Champia indica* and *Sargassum tenerrimum* from the coastal belt of Sutrapada of Saurashtra coast. Seaweed were crushed by mortar pestle grinded to powder. The powders were used for preparing the extract in chloroform and acetone: Water (1:1). We soaked 10 gm of seaweed powder in 50 ml of solvent for 24 hrs and then filtered it using Whattman filter paper-no 1. The sample prepared were analyzed for different phytochemical qualitative analysis of various parameters like steroids [8], tannin [9], Coumarin [9], Phytostetol [10], Phenolic compounds [9], Flavonoids [11], carbohydrates [8], Proteins [8], Phiobatannis [11], Reducing sugar [10], Amino acids [8], Glycosides [10], and Terpenoids [8].

(A) Gujarat (B) Sutrapada

Fig. 1. Map showing study area

3. RESULTS AND DISCUSSION

Here, total ten phytochemicals such as steroid, tannin, flavonoids, carbohydrate, reducing sugar, amino acids, protein, glycosides, terpenoids and phenols compounds were present in this class. While coumerins, phytostetol and phiobatannis were not-present in this class.

Total 11 phytochemical present in three different species of Phaeophyta class. Which is steroid phytostetol tannin coumerins phiobatannis flavonoids Carbohydrate Reducing sugar Protein glycosides terpenoids. Here phenols compounds and Amino acids were absent with respective tests.

Here, steroid, phytostetol, tannin, coumerins, flavonoids, carbohydrate, reducing sugar, amino acids, protein, glycosides, terpenoids and phenols compounds total 12 chemical present in Rodophyta classes. In which Phiobatannis is not-present in this class.

In Rhodophyta class total twelve phytochemical are present out of thirteen. And (A,B,C) indicates that particular algae name and present of phytochemical in any one or both solvent extract. 1,2,3 shows the particular phytochemical present in how many algae species.

In both extracts *Scinaia carnosa, Champia indica* (Rhodophyta)*, Ulva lactuca* (Chlorophyta) has good source of phytochemical.

Table 1. Phytochemical analysis of *Chlorophyta* class

Sr. no.	Phytochemical test	*Caulerpa racemosa* (A)		*Chaetomorpha crassa* (B)		*Ulva lactuca* (C)	
		CE	AWE	CE	AWE	CE	AWE
1.	Steroid	-	+	-	-	-	+
2.	Phytostetol (Salkowski's test)	-	-	-	-	-	-
3.	Tannin	-	+	-	+	+	+
4.	Coumerins	-	-	-	-	-	-
5.	Phiobatannis	-	-	-	-	-	-
6.	Alkaline(Flavonoids)	-	-	-	-	+	+
7.	NH4OH (Flavonoids)	-	-	-	-	-	+
8.	Zn-Test (Flavonoids)	-	+	-	-	-	+
9.	Carbohydrate(Fehling'S)	+	-	+	-	+	-
10.	Reducing sugar(Benedict's)	+	-	+	-	+	+
11.	Amino acids (Ninhydrin test)	-	+	-	-	+	+
12.	Protein (Million tests)	+	-	-	+	-	-
13.	Glycosides (Keller-Kiliani Test)	+	+	+	+	+	-
14.	Terpenoids (Salkowski test)	+	-	+	-	-	+
15.	Phenols compounds (Ferric chloride test)	+	-	-	-	+	+
16.	Carbohydrates (Molisch test)	-	-	-	-	+	-

**(CE: Chloroform extract, AWE: Acetone: Water extract)*

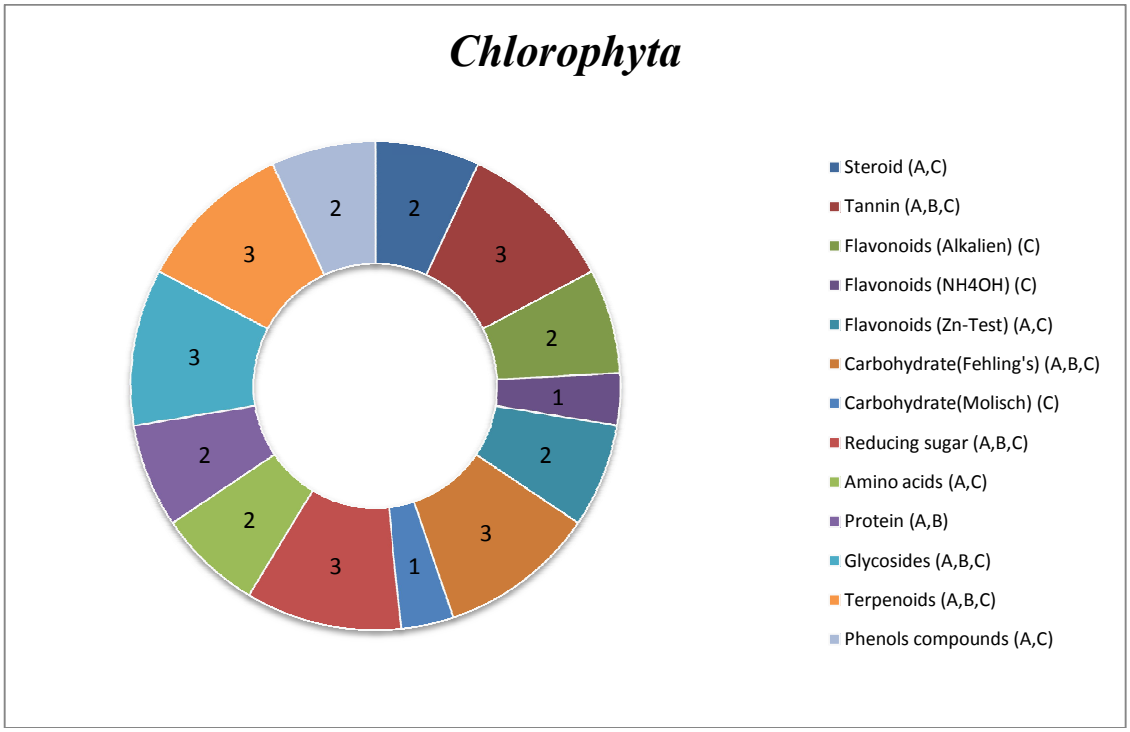

Chart 1. *Chlorophyta* seaweed phytochemicals

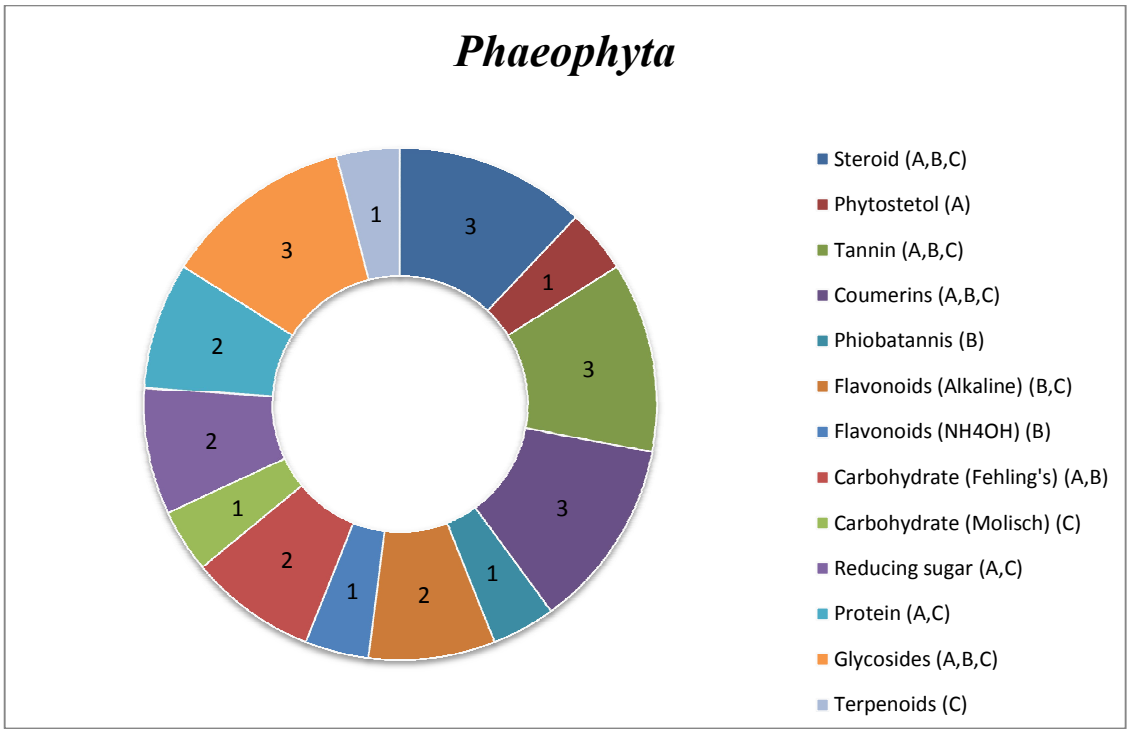

Chart 2. *Phaeophyta* seaweed phytochemicals

Table 2. Phytochemical analysis of *phaeophyta* class

Sr. no.	Phytochemical test	*Padina tetrastromatica* (A)		*Giffordia mitchellae* (B)		*Sargassum tenerrimum* (C)	
		CE	AWE	CE	AWE	CE	AWE
1.	Steroid	-	+	-	+	-	+
2.	Phytostetol (Salkowski's test)	+	-	-	-	-	-
3.	Tannin	+	+	+	-	+	+
4.	Coumerins	-	+	+	-	+	+
5.	Phiobatannis	-	-	+	-	-	-
6.	Alkaline(Flavonoids)	-	-	+	-	+	+
7.	NH4OH (Flavonoids)	-	-	-	+	-	-
8.	Zn-Test (Flavonoids)	-	-	-	-	-	-
9.	Carbohydrate(Fehling'S)	+	-	+	-	-	-
10.	Reducing sugar(Benedict's)	-	+	-	-	+	+
11.	Amino acids (Ninhydrin test)	-	-	-	-	-	-
12.	Protein (Million tests)	-	+	-	-	+	+
13.	Glycosides (Keller-Kiliani Test)	+	+	+	+	+	+
14.	Terpenoids (Salkowski test)	-	-	-	-	+	+
15.	Phenols compounds (Ferric chloride test)	-	-	-	-	-	-
16.	Carbohydrates (Molisch test)	-	-	-	-	+	+

**(CE: Chloroform extract, AWE: Acetone: Water extract)*

Table 3. Phytochemical analysis of *Rhodophyta* class

Sr. no.	Phytochemical test	*Scinaia carnosa* (A)		*Halymenia venusta* (B)		*Champia indica* (C)	
		CE	AWE	CE	AWE	CE	AWE
1.	Steroid	-	+	+	+	+	+
2.	Phytostetol (Salkowski's test)	-	+	+	-	+	+
3.	Tannin	+	-	-	+	+	+
4.	Coumerins	+	+	-	-	+	-
5.	Phiobatannis	-	-	-	-	-	-
6.	Alkaline(Flavonoids)	+	+	-	+	+	-
7.	NH4OH (Flavonoids)	+	+	-	-	-	+
8.	Zn-Test (Flavonoids)	-	-	-	-	-	-
9.	Carbohydrate(Fehling'S)	-	-	+	+	-	-
10.	Reducing sugar(Benedict's)	-	+	+	+	+	-
11.	Amino acids (Ninhydrin test)	-	+	-	+	-	-
12.	Protein (Million tests)	-	+	-	+	+	+
13.	Glycosides (Keller-Kiliani Test)	-	+	+	-	+	-
14.	Terpenoids (Salkowski test)	+	-	+	-	+	-
15.	Phenols compounds (Ferric chloride test)	-	+	-	-	+	+
16.	Carbohydrates (Molisch test)	-	+	+	+	-	-

**(CE: Chloroform extract, AWE: Acetone: Water extract)*

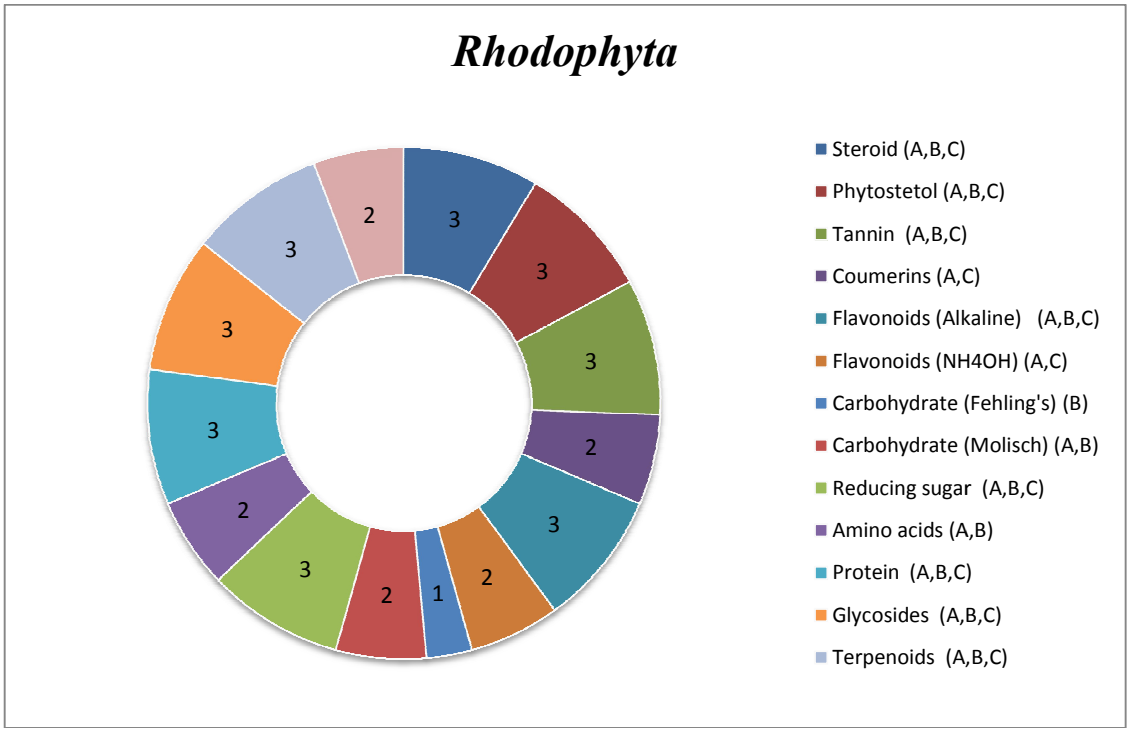

Chart 3. *Rhodophyta* seaweed phytochemicals

Table 4. Class wise phytochemicals

Sr. no.	Class	Total seaweeds species	Present phytochemical
1.	*Chlorophyta*	3 (A,B,C)	10
2.	*Phaeophyta*	3 (A,B,C)	11
3.	*Rhodophyta*	3 (A,B,C)	12

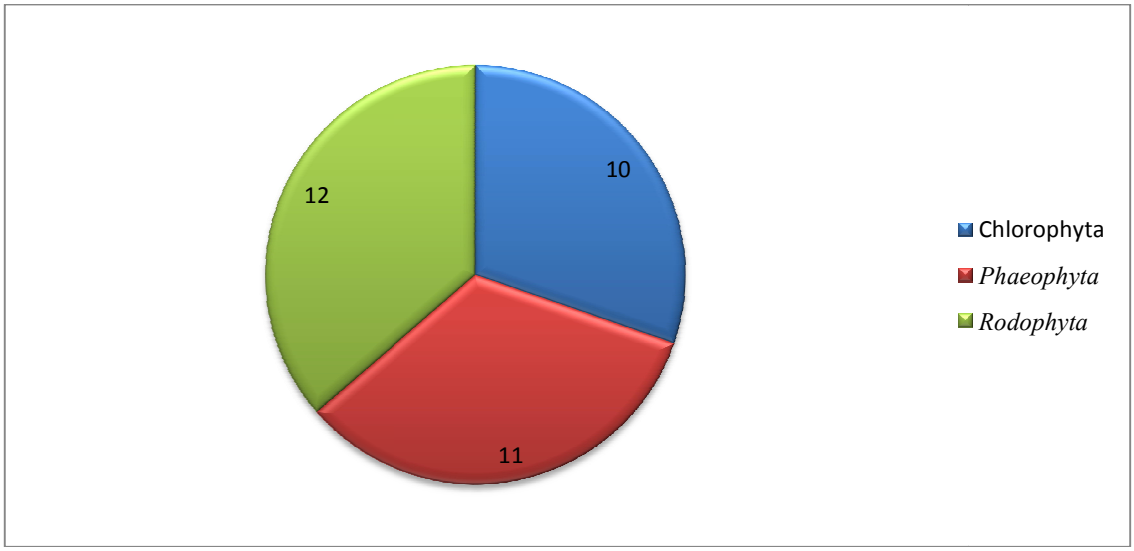

Chart 4. Total number of phytochemical present in each class

4. CONCLUSION

Seaweeds are rich in majority of secondary metabolites and hence have high potential of curing many diseases. In the present study seaweed in chloroform and acetone:water extract showed immense results justifying its efficiency as medicinal properties. It is also concluded from the results which showed the maximum presence of phytochemicals in acetone:water extract class *Rhodophyta* comprises of more phytochemical constituents than that of other two classes. Three seaweed species *Scinaia carnosa, Champia indica* (Rodophyta)*, Ulva lactuca* (Chlorophyta), were having rich in secondary metabolites which could be further isolated for biological activities for conforming their role in specific diseases.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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